Who are the bilinguals (and monolinguals)?

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Who are the bilinguals (and monolinguals)? Commentary on "Bilingualism and Cognition"

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In the keynote article, "Bilingualism and Cognition", Valian has reviewed current research on comparing executive function (EF) in monolingual and bilingual individuals across the lifespan. The conclusion is that there are inconsistent EF advantages from bilingualism and all other cognitive challenging activities primarily because individual differences in these cognitive challenging experiences may collectively attribute to superior EF resulting in inconsistent EF benefit attributable to a single experience. In essence, variability in study participants' experience and tasks contributes to the inconsistency in the behavioral outcomes observed in monolinguals and bilinguals. Notably, Valian suggests that monolinguals may also engage in other cognitively challenging activities, which have not been accounted for in individual studies, thereby resulting in improved EF similar in magnitude to that related to bilingual experience. Although it was not specified which cognitively challenging activity is more likely to be systematically engaged by monolinguals more than by bilinguals, the question at heart is: is there an EF advantage that can be specifically attributed to bilingual experience? The review addressed in the keynote demonstrates seemingly inconsistent patterns of results. In this commentary, I would like to suggest that, in addition to task measurements, individual bilingual experience is dynamic and multifaceted. Moreover, bilingual experience varies in different communities. Consequently, one potential source of explanation for the inconsistent results in

between-group EF performances is the characteristics of the bilinguals (and monolinguals) and their social environments included in these studies.

Who are the bilinguals (and monolinguals)? As much as researchers would like to have mutually exclusive groups including individuals with bilingual or monolingual experience, it may not be realistic because bilingualism and monolingualism may represent extremes of a multidimensional spectrum, such as history of language acquisition (e.g., Luk, De Sa & Bialystok, 2011), language usage (e.g, Luk & Bialystok, 2013; Prior & Gollan, 2011), and second language proficiency (e.g., Mishra, Hilchey, Singh & Klein, 2012; Tse & Altarriba, 2014). The exact nature of how these dimensions in bilingual experience interact with each other and components representing EF is still unclear. Therefore, it is imperative to consider participants' characteristics when interpreting differences in behavioral outcomes. This consideration should apply to both bilingual and monolingual participants. Given that bilingualism is influenced by social interaction (Grosjean, 1982; Lambert, 1967), it is also important to report the social environment pertaining to both the bilingual and monolingual participants (for an extensive global perspective on this topic, see Romaine, 2012). Although bilinguals may have a choice to retain usage of another language, as suggested by Valian (Valian), this choice is likely driven by the social value of using a minority language. In summary, bilingual characteristics should be reported for both the intraindividual (dimensions of bilingualism) and interindividual (social values of bilingualism vs. monolingualism) domains.

Relevant to EF performance is the intensity and duration of bilingual experience engaged by the participants persistently. Cross-sectional between-group comparisons may introduce group differences unrelated to bilingual experience, as suggested by Valian (Valian). One critical question is, how much (what type of) bilingual experience is enough? This question can only be

speculated in a longitudinal design or prospective cohort study. A recent study by Macnamara & Conway (2014) demonstrated that American Sign Language (ASL)–English interpretation students showed significant gains in cognitive control and working memory after two years of high demand of managing both ASL and English. These behavioral gains were specific to the experience of needing to manage two languages, but not related to preexisting cognitive abilities and other possible confounding factors. Findings from this study demonstrate that sufficient intensive bilingual management is necessary to enjoy cognitive enhancements. In a large-scale prospective longitudinal study involving 964 older adults, those who reported receiving longer duration of foreign language instruction before the age of 18 had a lower risk of mild cognitive impairment after controlling for age, sex and education (Wilson, Boyle, Yang, James & Bennett, 2014). Similar findings were also reported for those with music instruction. Together, these findings point to the importance of qualifying and quantifying bilingual experience when interpreting between-group comparisons.

Aside from the intensity of demand involved in managing two languages, second language proficiency also plays a role in relation to EF performance. Linck, Osthus, Koeth & Bunting (2014) reported that second language proficiency (comprehension and production) was associated with working memory, in a meta-analysis involving 79 independent study samples of 3707 adult participants. The effect sizes were relatively larger in verbal working memory measures and executive control component, suggesting second language processing may recruit domain-general processes. In addition, Fernandez, Tartar, Padron & Acosta (2013) and Tse & Altarriba (2014) reported that second language proficiency correlated with N2 amplitude (an ERP component representing inhibition of motor response or response selection) and reaction time distributions respectively in the Simon task. Critically, these findings suggest the

importance of considering second language proficiency when evaluating EF performance in bilinguals.

Recent neuroimaging research has suggested that overlapping brain regions showed activity between bilingual language control and domain-general cognitive control (e.g., Abutalebi, Della Rosa, Green, Hernandez, Scifo, Keim, Cappa & Costa, 2012; de Bruin, Roelofs, Dijkstra & Fitzpatrick, 2014; for a meta-analysis, see Luk, Green, Abutalebi & Grady, 2012). Although neuroimaging findings do not imply underlying cognitive mechanisms, when overlapping brain regions engage in bilingual language control and EF, it suggests that managing multiple languages is not a (neurologically) modular process. Complementing Valian's suggestions of focusing on specific EF components relevant to bilingualism and conducting detailed task analyses, I recommend examining bilingualism and cognition using multiple methodologies: such as testing specific hypothesis in large-scale cohort datasets, designing theory-driven behavioral tasks and adopting multimodal neuroimaging methods. Furthermore, bilingualism provides a unique window to examine the interaction between experience-expectant (e.g., maturational) and experience-dependent (e.g., interaction between an individual and the environment) mechanisms. Inconsistent findings may reflect possible differences in individual and/or social contexts in which bilingualism occurs and captured by the researchers. More detailed report and analysis of the diversity in experience-dependent mechanisms is needed in advancing research on bilingualism and cognition.

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